sometimes as careless as he was capable, and that he rarely used his great abilities to the full. He belonged to the school of explorers who prefer rapid traverses and pioneer work, to scientific investigations and detailed surveys. He reminds us by his geographical work of Livingstone, and by his love of sport of Selous, rather than of men like Fischer, Schweinfurth and Junker. He was fonder of the field than of the library, and often did not, apparently, know which of his results were new, and which were known before. The thing of which he was proudest was that he had never taken the life of a native, for he had avoided hostilities owing to his tact and infinite patience, which was especially creditable to a man of such an impulsive temperament. His love of peace, however, was not due to any fear of war, for he was brave to recklessness. That he felt warmly, and could speak impatiently, was shown by his criticisms upon the management of the Emin Relief Expedition. In his most famous expedition it was unfortunate that he followed such a trained naturalist and learned ethnographer as Fischer, and was himself followed by such a laborious and skilled cartographer as von Höhnel. On the other hand, this journey was the one which showed Thomson's powers at their best; for he then had the fullest scope for the exercise of his tact as a leader of men, his dash and daring as an explorer, his enthusiasm as a sportsman, and the consummate skill with which he gained the affections of his men and the confidence of suspicious natives. The same qualities won him respect at home. He is described, by those who knew him, as singularly modest and unassuming. His frank sincerity and genial humour endeared him to a wide circle of friends, who devotedly cared for him in his long illness, and now mourn his early death.

J. W. GREGORY.

WILLIAM CRAWFORD WILLIAMSON.

WHEN the author of this article began the work for his "Einleitung in die Palæophytologie," he soon realised that it was quite impossible to produce such a book without an accurate knowledge of Williamson's collection of sections. He therefore wrote to Manchester and requested permission to make use of the collection. An invitation to Williamson's hospitable house was the immediate result. He there spent eight delightful and busy days, during which the host was never weary of demonstrating his specimens to his guest, who was astonished at their abundance, or of imparting to him the fullest information from his store of knowledge. The guest departed with feelings of the warmest respect and gratitude. In the course of the following years, however, he has often again had the privilege of returning to Manchester and London, and of knitting closer the bonds of reverence and friendship with him who is gone. The last occasion was in the spring of the current year, when the writer left with the conviction that it had been their last meeting. Williamson's death actually took place at Clapham Common, on June 23, when in his seventy-ninth year.

William Crawford Williamson was born at Scarborough, on November 24, 1816. His father, John Williamson, a gardener by profession, but by the bent of his mind a naturalist, and especially a geologist, was a zealous colleague of William Smith, who was attached to him both by friendship and by their common pursuits, and who spent two whole years, 1826–1828, under his roof.

Young Williamson's father encouraged his scientific tastes, even from his earliest days; his observational faculties were strengthened by frequent excursions; the association with Smith, and with the circle of active geologists of that fruitful period, influenced his boyhood, and left behind an effect which lasted his whole life. He has often told the writer about his geological and botanical rambles with his father and friends along the beautiful cliffs of the Scarborough and Whitby coasts. He had an extraordinary love for his more immediate home, and was proud to call himself a Yorkshireman.

Williamson's first publications, "On a Rare Species of *Mytilus*," and "On the Distribution of Organic Remains in the Lias Series of Yorkshire," appeared when he was only in his eighteenth year. About the same time he also contributed a considerable number of drawings to Lindley and Hutton's "Fossil Flora of Great Britain," a work which was completed in 1837, when he was twenty-one. In his later years he did not continue to work much at remains preserved as impressions, for his whole interest had become diverted to anatomical studies. One or two papers on *Zamia gigas* (now called *Williamsonia*), however, owe their origin to the material accumulated in those youthful days. The last and most important of these papers appeared in 1870, in the *Transactions* of the Linnean Society, vol. xxvi., under the title "Contributions towards the History of *Zamia gigas*."

Williamson's family was not much blest with this world's goods. He was therefore obliged to adopt some practical calling, and naturally chose the medical profession, for which he prepared, first at Manchester, while at the same time acting as Curator of the Natural History Museum there, and subsequently in London. In 1840 he became member and licentiate of the Royal College of Surgeons. Soon afterwards he settled in Manchester as a medical man, and remained there over fifty years, carrying on for a long time an extensive practice. In addition to this the professorship of Geology and Natural History at the Owens College was conferred on him in 1851, an office which he administered, in its full extent, for many years. In 1872, however, he handed over the geology to Boyd Dawkins, and from 1880 onwards gave up the zoology, and confined himself to botany. This he continued to teach down to 1892, when his decreasing bodily strength compelled him to retire altogether. He then removed to London, in order that with the aid of the greater facilities there offered he might the better advance the scientific work, which he was still zealously pursuing. Here, after three more years, he too soon ended a life of which one may certainly say, with the Psalmist, that its strength was labour and toil.

For medical practice and professorial duties, though strenuously and most conscientiously carried on, did not satisfy Williamson's mighty power of work. Concurrently with these occupations, a constant flow of scientific production went on, the many-sidedness of which is scarcely conceivable to the present generation. Not only did he write articles in medical journals, which lie beyond the scope of the present notice, he also continued to work with the greatest zeal at zoology, botany, and, above all, geology and palæontology, as is testified by his numerous publications—large and small.

From his youth upwards, Williamson had been much occupied with the investigation of fossil fishes, and in the latter half of the thirties, and beginning of the forties, he wrote various memoirs on this subject. His studies of lower organisms gave rise to the works on *Campylodiscus*,[1] on *Volvox Globator*,[2] and on *Foraminifera*, the last and most important of which, embracing the whole of his researches on the subject, was published by the Ray Society in 1858, under the title of "The British Foraminifera." These writings have received due acknowledgment in the works of Carpenter and Bütschli.

In 1833 the remarkable work by Witham, of Lartington, appeared, in which the study of the internal structure of carboniferous fossil plants was entered upon for the first time, with the help of the thin ground sections invented by Nicol. This work laid the foundation of our knowledge of the structure of the *Lepidodendra* and *Stigmariæ*, and Brongniart then applied the new method, with the most brilliant success, to the investigation of *Sigillaria*. Williamson also soon attained brilliant results by its aid, studying the shells of Foraminifera, and the scales and teeth of fishes. Two papers, published in the *Philosophical Transactions* (1849 and 1851), and considered excellent by competent judges, were the result.

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[1] "Annals of Nat. Hist." vol. i., 1848.

[2] *Memoirs* of the Manchester Lit. and Phil. Soc., vol ix. 1851, and *Transactions* of the Microscopical Soc., vol. i., 1853.

Naturally, the study of fossil plants, which had been so successfully begun, was not neglected, whenever such material could be obtained in the proper state of preservation, which at that time was not easy. Williamson's first attempt of the kind, the precursor of the whole palæobotanical literature which he created, was the paper "On the Structure and Affinities of the Plants hitherto known as *Sternbergiæ*," in which the *Sternbergiæ* were identified as medullary casts, which had been surrounded by an Araucarian wood. As already mentioned, however, the material for an extended use of the method was at that time still wanting. Then, just at the right moment, came the discovery of the calcareous nodules, enclosing vegetable remains, in the Ganister beds of the coal-fields of Lancashire and Yorkshire. The investigation of the treasures thus revealed was first taken in hand by their discoverer, Binney himself, and subsequently by Carruthers and Williamson. The latter first began with works on the Calamarieæ, three of which appeared in rapid succession from 1869 to 1871. They are: "On the structure of an undescribed type of *Calamodendron* from the upper coal-measures of Lancashire"; "On a new form of Calamitean strobilus"; and "On the organisation of an undescribed verticillate strobilus from the lower coal-measures of Lancashire."

As was necessarily the case, material now began to accumulate in Williamson's hands, and he enjoyed the active co-operation of various zealous collectors. Then, in his fifty-fifth year, he began the great series of memoirs which mark the culminating point of his scientific activity, and which will assure to him, for all time, in conjunction with Brongniart, the honourable title of a founder of modern Palæobotany.

In the course of the following twenty years, nineteen memoirs of this series appeared in the *Philosophical Transactions*, under the general title "On the Organisation of the Fossil Plants of the Coal-measures." They all contain exclusively his own observations, made entirely on material from the British coal-fields. It is a gigantic work, which by itself alone would form the abundant fruit of a man's whole life. It was supplemented, however, by various other contributions to the same subject, published in the *Memoirs* of the Literary and Philosophical Society of Manchester, the *Annales des Sciences naturelles*, and the *Annals of Botany*. During the same period, in 1887, also appeared Williamson's exhaustive "Monograph on the Morphology and Histology of *Stigmaria ficoides*," which will long form the basis of our knowledge of these fossils.

The recognition by palæontologists and botanists of the full importance of these works of Williamson's, has been of course a slow and gradual process. This was really due to external circumstances. In the first place, Williamson found it necessary, as the material in his collection, and his own experience increased, to return repeatedly in his later memoirs to plant-remains which had been dealt with in the earlier parts. Consequently, if we wish to obtain an idea of any group, it is always necessary to study several of these treatises simultaneously. This, however, presents great difficulties, except to those who possess separate copies. For the reader stands helpless before a pile of sixteen volumes of the *Philosophical Transactions!*

On the other hand, there is another point which must be taken into account. Williamson's method of anatomical description, clear as it is, bears the stamp of the scholastic ideas of a past time. For this reason it is only understood with difficulty by the botanists of the present day, and must often first be translated into the form now customary. This is laborious, and has stood greatly in the way of the rapid diffusion of his results.

Williamson himself was fully conscious of these drawbacks, and finally, in order to remedy them, he began a new series of memoirs, in conjunction with Dr. Scott, the object of which was to present a connected and systematically-ordered account of the results obtained, clothed in the language of modern anatomy. The first memoir of this series appeared in 1895, in the *Philosophical Transactions*, and treats of the Calamarieæ and Sphenophylleæ. Two further papers are already completed, but he was not spared to see them published.

The basis of all Williamson's labours in fossil botany is, of course, the collection of slides which he left, containing some thousands of preparations. It is unique of its kind in the world, and of the greatest importance, for it contains the evidence for all the innumerable special observations recorded in his works. Like Willdenow's herbarium or Lindley's collection of orchids, it will always remain an invaluable source of information, to which palæontologists from all sides must resort. Its owner was aware of this, and so also is the author of this notice, who may boast that he knows the collection as scarcely any one else does. It was through him that Williamson decided to prepare and distribute, in a printed form, a detailed index, giving exact references to the individual preparations, and the places where they are cited in the memoirs. This was necessary, for the multitude of preparations often made it very laborious, even for the owner, to look out a particular section to demonstrate some special fact. This work was taken in hand about 1890, and has considerably increased the usefulness and value of the collection to posterity. Three instalments, and those the most important, have already appeared under the title, "General Morphological and Histological Index to the Author's Collective Memoirs on the Fossil Plants of the Coal-measures." Only the Cordaiteæ, the Gymnospermous seeds, and a number of fossils of doubtful affinity, are still wanting. We may, no doubt, ultimately look for a synopsis of these from the hand of a friend, so as to complete the entire work.

If we now consider the contents of the palæobotanical literature created by Williamson during the last twenty-five years of his life, we find that it consists, first of all, of the most minute description and reconstruction of all those types of plants which took part in the formation of the coal-beds of Great Britain. He abstained on principle from concerning himself with non-British material. We have acquired from him the most exact knowledge of the structure of the Calamarieæ, the Lepidodendreæ, the Sphenophylleæ, the Ferns, and Lyginodendreæ. As regards several of these groups, it is true, he had before him fairly detailed investigations by previous observers, but in other families, especially the Calamarieæ and Lepidodendreæ, he himself laid almost the whole foundation of our knowledge. He showed that both groups are, as regards their fructifications, indubitable Archegoniatæ, but that they possessed, like our recent Gymnosperms, a secondary formation of wood from a cambium; he taught us to recognise, in the Stigmariæ, the subterranean organs of the Lepidodendreæ and Sigillariæ; he reconstructed in the genera *Lyginodendron* and *Heterangium*, described by him, a type of plant which, by its characters, occupies an intermediate position between Filicineæ and Gymnosperms, especially Cycadeæ. It thus can find no place in the system of recent plants, but represents a direct derivative of the unknown ancestral stock from which the two groups still living have also sprung. In connection with this type, Renault's Poroxyleæ have since turned out to be their later Permian relations, while the Protopityæ of the Culm are more ancient allies, with similar characteristics. We thus learn how far back we must go, in the series of geological formations, in order to meet with the last traces of the common ancestors of those classes in the vegetable kingdom which are now living.

By his discovery of Archegoniate plants with secondary growth, Williamson however came into collision with the doctrines of Adolphe Brongniart, otherwise so highly reverenced by him, who held this character to be an absolute criterion of the Phanerogams, and denied the possibility of its occurrence in other classes of the vegetable kingdom. Hence a literary feud arose between Williamson and B. Renault, Brongniart's distinguished pupil. The latter endeavoured to prove that Williamson was in error in the identification of his *Lepidodendra*, that they were really *Sigillariæ*, and together with the latter belonged to the Gymnosperms, while the truly Archegoniate *Lepidodendra* were destitute of any secondary growth. The answer was not long in coming; proof was heaped on proof, until ultimately the real state of the case was made completely clear. In all essential points victory was on the side of our author. Other subsidiary differences respecting *Stigmaria*, the Calamarieæ, &c., require no more than a mention here.

It was thus made evident by Williamson that cambial growth in thickness is a character which has appeared repeatedly in the most various families of the vegetable kingdom, and was by no means acquired for the first time by the Phanerogamic stock. This is a general botanical result of the greatest importance and the widest bearing. In this conclusion Palæontology has, for the first time, spoken the decisive word in a purely botanical question. The result has proved well worth the great trouble and labour which had to be gone through in order to attain it.

It would be difficult to conceive a more magnificent monument to Williamson than one which he himself set up at Manchester, in one of the halls of the Owens College Museum.

In the year 1887 there was discovered in a quarry near Bradford, a gigantic petrified tree-stump, which, when carefully exposed, was found to run out at the base into a widely-spreading system of ramifications of a Stigmarian character. In the quarry this precious relic, like many others before it, would in a very short time have fallen a victim to destruction by weather and the hand of man. Williamson, however, acquired it by purchase, had it carefully subdivided into numerous pieces, and brought it home safe and complete to Manchester. This was not accomplished without the greatest personal exertions and a considerable expenditure of money (to which several friends contributed), for there were whole waggon-loads of material to be removed. Then the first thing which had to be done was to secure from the University authorities the necessary space for erecting the fossil. This was not an easy matter, and great opposition had to be overcome, as we can easily understand on looking at the specimen, which measures over 29 feet in diameter.

Finally it was fitted together, piece by piece, and fixed in its natural position, resting on a massive pedestal of brickwork. The fiery youthful zeal of a man already over seventy, overcame all the difficulties that arose. People were astonished at the unusual development of energy which this *Stigmaria* had caused, and gave it, in good-humoured jest, the name of "Williamson's Folly." "Williamson's Folly" may now be reckoned among the sights of England, and Manchester may be proud of possessing it, for it represents a last gift, worthy of all honour, from the deceased, to the place which for so many years was his home and the scene of his activity.

The author of this notice, who only knew Williamson during the last years of his life, must not attempt to picture to those who lived with him his kindly and benevolent nature, which always retained the freshness of youth, or his simple character. That would be a work of supererogation, for the whole of scientific England knew and respected him, and wherever he went he was a welcome and honoured guest. The writer can only report, in all brevity, on the work of Williamson's life, and when asked to undertake this, it was with pleasure that he took up his pen for that purpose. SOLMS-LAUBACH.

NOTES.

THE resignation of Dr. Albert Günther, F.R.S., of the post of Keeper of Zoology at the Natural History Museum, South Kensington, is announced. Dr. Günther has occupied for over thirty years the position he now vacates.

THE "Swiney" Lecturer this year is Dr. J. G. Garson, who will take as the subject of the twelve lectures he purposes giving, "The Geological History of Man." The lectures, admission to which will be free, are to be delivered in the lecture theatre of the South Kensington Museum on Mondays, Wednesdays and Fridays, at five P.M., beginning on Friday, October 4.

WE have to record the death of two prominent members of the medical profession abroad, viz. Dr. Pasquale Landi, Professor of Clinical Surgery successively in the Universities of Siena, Bologna, and Pisa, and Dr. Texier, Professor of Internal Pathology in the Medical School of Algiers.

MR. CHARLES MITCHELL, whose death, at the age of seventy-five, occurred on August 22, was a well-known engineer and shipbuilder. He founded the Walker shipbuilding yard on the Tyne, a yard which under his guidance developed into one of the largest in the country. In 1882 it was merged into the Elswick Company of the present Lord Armstrong, and up to the time of his death Mr. Mitchell practically superintended the whole of the shipbuilding work of the Company.

THE *Athenæum* says that during the autumn of this year a monument is to be unveiled at Osteel, in East Friesland, in memory of the discoverers of the sun's spots, David and Johann Fabricius. The site chosen is the place in the cemetery where the grave of the elder Fabricius was discovered about nine years ago.

WE are informed by Prof. John Milne, that communications respecting the *Transactions* of the Seismological Society, and the *Seismological Journal*, may be addressed to him at Shide Hill House, Shide, Newport, Isle of Wight, at which place a small station has been established to record earthquakes having their origin in distant localities, and other unfelt movements of the earth's surface.

THE annual general meeting of the Federated Institution of Mining Engineers will be held in North Staffordshire, at Shelton, Stoke-upon-Trent, on September 18 and 19, when papers on "The Depth to Productive Coal-measures between the Warwickshire and Lancashire Coal-fields," "Gold-mining in Nova Scotia," "The Use of Steel Girders in Mines," "Economic Minerals of the Province of Ontario, Canada," and "The Blasting Efficiency of Explosives" are expected to be read, and a discussion of various papers which have already appeared in the *Transactions* of the Institution may take place. A number of excursions are also arranged.

THE fifth quadrennial meeting of the International Congress of Otology will take place at Florence, under the presidency of Dr. V. Grazzi, from September 23 to 26. Various discussions will be opened by Dr. Barr of Glasgow, Dr. Gellé of Paris, Prof. Gradenigo of Turin, Prof. A. Politzer of Vienna, and Dr. Secchi of Bologna; and there are in the complete programme,